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FOREST SERVICE

RP-CAL
TIMBER CONVERSION
Logging and milling
Blacks Mountain Experimental Forest

December 16, 1940

Log and Tree Values of the 1939 Blacks Mountain Mill Study

By

Hereford Garland, Assistant Conservationist
Division of Forest Products
California Forest and Range Experiment Station

OFFICE REPORT
NOT FOR PUBLICATION

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M.J. 12/19/40
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OFFICE REPORT
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Log and Tree Values of the 1939 Blacks Mountain Mill Study

by

Hereford Garland[1/]

A "tree-to-shipping grade" lumber grade production study was made at the mill of the Fruit Growers Supply Company, Susanville, California, using trees selected from one of the 1939 cutting plots of the Blacks Mountain Experimental Forest.

The objectives of the study as quoted in part from the plan[2/] for the study by its initiator, Thos. J. Orr, Jr.[3/] are as follows:

The proposed mill study is the first of a series of small studies designed primarily to investigate some of the economic aspects of the cutting methods now being tested at Blacks Mountain. One method of cutting is based primarily on the relative susceptibility of individual trees to insect attack. The immediate study is to evaluate the trees by size, and by the four risk classes defined by the Bureau of Entomology and Plant Quarantine, Forest Insect Laboratory, at Berkeley.

In addition to the evaluation of the four risk classes, it is proposed later to apply similar tests to Dunning's and to Keen's tree classes, and possibly to some system of tree grading that may develop as a result of the information gleaned from the first sample. Since the data are to be classified in several different ways, it is necessary to retain the identity of the tree from which each board originates throughout the manufacturing process. In the present study the determination of the errors involved in applying the system is equally as important as the determination of the actual values themselves.

It remains to be seen whether such differences are best explained in terms of log grades, or whether the design of a system of tree grades should be attempted. Ultimately, it is hoped to reach a satisfactory means of predicting tree values whether such a system is based upon a tree quality classification or upon a log grade classification. The first sample is expected to indicate in which direction the answer lies, rather than to provide an adequately controlled predicting system. The application of this predicting system ties back to the financial aspects of a cutting system, and hence to the first objective mentioned.

1/ Assistant Conservationist, Division of Forest Products, California Forest and Range Experiment Station

2/ Working plan for a mill study to determine tree values of Blacks Mountain Experimental Forest in cooperation with the Fruit Growers Supply Co. Office report, CF&RES, U. S. Forest Service, August 1939.

3/ Formerly Junior Forester, Division of Forest Products, California Forest and Range Experiment Station, U. S. Forest Service.

The proposed study differs from the earlier studies in that the sample is designed to secure adequate representation of tree classes as contrasted to the earlier problems of classifying logs. The sample has been limited to a convenient size, about 120 to 140 M feet b.m., to secure better control of the field work. The statistical validity of the data will increase as subsequent samples are taken and studied.

Tree Selection

The study trees were marked on the 20-acre "clear cut" sample plot which afforded the best diameter range among the 5 experimental cutting plots of the 1939 series. All trees on these plots were classified by Dunning's, Keen's, Anderson's, and insect risk classifications. The last named system defined four insect risk ratings "for ponderosa and Jeffrey pine in eastside forest areas of California" based on "apparent vigor of crown as evidenced by foliage, twigs, and branches."

Following are the descriptions of the insect risk classes:

RISK 1. LOW RISK

Full foliaged, healthy appearing crowns. Foliage of healthy appearance, needles usually long and coarse, color good dark green. Practically all twigs with normal foliage complement. No weakened portions of crown.

RISK 2. MODERATE RISK

Fair to moderately healthy crowns, imperfect in spots. Foliage mostly healthy, needle length average or better, color fair to good. Some twigs or branches may lack foliage, but such injury should not be localized to form definite "weak" spots in crown.

RISK 3. HIGH RISK

Crowns of fair to poor health, somewhat ragged or thin in portions of crown. Foliage in parts of crown thin, bunchy, or unhealthy, needles average to shorter than average in length, color fair to poor. Some to many twigs or branches lacking foliage, one to many twigs or branches fading or dead. Small localized weakened portions of crown usually present.

RISK 4. VERY HIGH RISK

Crowns in poor condition, ragged or thin, often showing evidence of active insect infestations in upper portions. Foliage thin or bunchy, needles short or sparse, color poor. Twigs and branches dead or dying, portions of crown definitely weakened. Active top-killing or partial infestations often present.

Some types of tree injuries are not associated with a normal rating of risk. They may be the result of accident, such as lightning or mechanical injury, and when such injuries affect the immediate risk of infestation and early death they should be appraised independently of the characters given above for rating risk. In addition, the following characters are not considered to be primarily concerned with current risk.

Stag Tops: An old bare spike, which is the result of an old topkilling injury from which the tree has recovered, is termed a stag top. Although a deterioration of the remaining crown often follows below stag tops and such trees may be rated as high risks, the stag top alone is not considered a character of high risk. When the remaining parts of the crown are vigorous and healthy, such trees can be considered low risks.

Mule Tail Foliage: In some trees the foliage has a distinctly bunchy appearance though the needles are long. This condition seems to be due to a peculiar development of the branches and apparently is a normal characteristic of a certain strain or type of pine tree. Other things being equal, it should be ignored in rating risk.

Off Color Due to Cold: In certain years and locations needles may be browned due to the effects of low temperatures. Light, local or generalized light browning of needles is not usually considered in rating risk. However, in some areas cold injury has been so severe as to cause a cambium injury in addition to a foliage injury. Severe injuries may have a considerable effect on the current risk from insect attack.

Cone Fade: Often, in seed years, needles behind the cones die and fade. Apparently this fading has no relation to risk.

Natural Needle Fall: During the fall months of the year, the normal fading of old needle complements may create an appearance of high risk. However, this needle fall is natural and the seasonal condition should not be counted as a factor in determining the risk of individual trees.

Natural Shading out of Branches: On most trees in a fairly closed canopy the lower branches lose their foliage and die. Such natural shading out of branches does not indicate high risk. This must be differentiated from the dying of twigs and branches in the upper, unshaded parts of the crown, a condition which is considered a definite indication of high risk from insect attack.

In stands, and in individual trees there apparently are no clearly marked steps in the change, over time, from a resistant to a susceptible condition or from a vigorous to a weakened condition. Those changes are marked by the appearance of no definite single character that can be used for all trees. Usually several or different evidences of deterioration develop in different trees. Some appear to be more particularly concerned with the early stages of deterioration while others may be more closely connected with the later stages."1/

Trees for this study were selected to obtain a good diameter range for each of these insect risk classes. Table 1 shows the distribution of study trees by diameter and risk class. Risk classes 3 and 4 have the poorer representation because of their scarcity in the stand. However, they have a better representation proportionate to the total stand distribution than have classes 1 and 2. This study sample cannot be regarded as "stand-run."

Procedure

The marked trees were reserved at the routine logging of the clear-cut plot and were later logged together. The woods logs (mostly 32 feet) were marked on both ends with tree number and position in the tree. They were then shipped to the mill on one string of cars and kept segregated in the mill pond.

For the lumber grade production study only one of four head-rigs was used. The woods logs were cut into mill log lengths on the mill deck and each mill log was given a serial number according to its sawing order. Mill logs were scaled by standard Forest Service procedure.

Each mill log was described from both sides as to size, number and character of knots and other external defects. This data furnished information for grading the logs by the 1938 edition of Brundage's compensated knot count grading system.

Each board from a study log was stamped with its log serial number. A rough tally was made between the edger and the trimmer by log number, lumber grade thickness, width and length for the purpose of checking the recovery of study boards in the dry tally.

One inch and 8/4 stock was kiln dried, immediately after sawing, then graded carefully and listed in the rough dry and surfaced condition. Six-quarter stock was air dried until July 1940 when it was carefully graded as rough lumber. Shop and better grades were surfaced and regraded. The remainder of the air dry stock, mostly box grades, were not surfaced but in evaluating logs these boards were priced as surfaced.

1/ Description furnished by Dr. K. A. Salmon, Bureau of Entomology and Plant Quarantine, Berkeley.

Table 1.- Distribution of study trees by d.b.h. and insect risk class.

Tree d.b.h. Class (inches)	Risk class 1	2	3	4	Total
12		2			2
14	1	1			2
16	1	2	1		4
18	2	2			4
20	1	2	1		4
22	1	1		1	3
24	1	2	2	1	6
26	2	2	1	1	6
28	2	2			4
30	2	2		2	6
32	1	2	2	1	6
34	2	2	1		5
36	2	1		1	4
38	1	2	2	3	8
40	2	3			5
42	1	1	2	1	5
44		2			2
46		2	1		3
48	1				1
50		1			1
52	1		1		2
	24	34	14	11	83

Each board was evaluated by two price lists, Schedule "A" (Table 2) compiled by Brundage and Schedule "B" (Table 3) compiled by Orr. Previous mill studies in this region have been evaluated by lumber grade only, from lists similar to Schedule "A". Schedule "B" giving prices by grade, thickness and width is a new departure and results in a truer diameter relationship for log values.

Analysis

Logs -- Lumber grade data were first summarized by individual logs and then the logs were grouped by grade and 4 inch diameter class. The summarization of lumber grade production by log grade and diameter group is presented in tables 4 to 11 along with average lumber selling values and other pertinent data.

Figure 1 illustrates the relationship between surfaced lumber selling value and log diameter for each log grade. Although these relationships have been shown in other studies as curvilinear with the rate of increase in value falling off in the larger diameters, a plotting of the individual log values showed such a dispersion that there was no clue to even a free hand curve form. The straight lines in these correlations were computed by the least squares method. The number of logs in each grade and the standard error of the individual logs is given with each regression line. All of the correlation coefficients are highly significant except that for grade 2.

The grades used here were designed by Brundage to produce fairly uniform spacing in value between grades. That grades 2 and 3 fail to fall into the general pattern may be attributed to (1) the small number of logs in these grades, (2) the lack of stand-run representations of logs and (3) the peculiarities of the stand in the 20 acre sample plot. Orr recognized this plot as of low quality. Hasel describes the stand as having an "open grown" history. Under these circumstances the log value lines of Fig. 1 may not be used for the purpose of prediction except in this immediate stand, nor can they be regarded as representative of any considerable area of east-side pine or of the experimental forest. The log grade data from this study will be combined with those of other comparable studies to arrive at accurate appraisal figures for the east-side region.

Figure 1 illustrates a statistical method of analyzing the value-diameter relationship for log grades. The standard error of estimate is a measure of dispersion of individual log values about each line of average relationship. It signifies the value deviation from the line within which approximately 68 per cent of the logs may be expected to fall. If a 30 inch grade 1 log were estimated from the grade 1 line at a value of $30.30 the chances are 68 in 100 that it will actually produce lumber at a value between ($30.30 + $6.15) = $36.45 and ($30.30 -$6.15) = $24.15.

Table 2.- Surfaced lumber selling prices by grade only, ponderosa pine, Schedule "A".

(Approximate averages for three year period 1935, '36 & '37, California Region, without reduction for freight allowances, commissions, trade discounts.)

Lumber grade	Selling price per M.B.M.
#1 & 2 Clear	$63.60
C Select	59.20
D Select	46.05
#3 Clear 5/4 & thicker	45.05
#3 Clear 4/4	31.05
#1 Shop	34.05
#2 Shop	24.00
#3 Shop	15.00
Inch Shop	19.70
Australian (not surfaced)	31.50
Molding Stock	24.00
#1 Common	38.90
#2 Common	28.90
#3 Common	20.30
#4 Common	15.70
#5 Common	11.30
#1 Box	15.85
#2 Box	11.30
Cull Box	7.00

Table 3.- Surfaced lumber selling prices by grade, thickness, width and length, ponderosa pine, Schedule "B".

Based on 1935-6-7 Regional Averages for California (S-Sales, Appraisals, Appraisal Handbook, May 5, 1938.) and "Selling Prices, Ponderosa Pine, Oregon District." (RE - M P M - Prices Lumber, R - 1; Reports for year 1937 and first three quarters year 1938).

Lumber Grade	Thickness	Short 8' and less	WIDTH 4"&5"	6"&7"	8"&9"	10"&11"	12"	13"+	20"+	All Widths
No. 1 & 2 Clear	4/4	36.81	55.53	57.52	60.09	60.92	74.06	75.34	75.34	
	5 & 6/4	"	63.13	65.31	66.83	67.48	70.02	76.41	83.33	
	8/4+	"	- - -	- - -	- - -	- - -	- - -	- - -	- - -	73.37
C Select	4/4	"	51.74	55.11	56.25	58.06	71.39	73.22	73.22	
	5 & 6/4	"	58.48	58.56	60.21	62.41	66.29	68.86	74.02	
	8/4+	"	- - -	- - -	- - -	- - -	- - -	- - -	- - -	69.32
D Select	4/4	"	39.36	43.89	44.96	47.71	57.78	57.91	57.91	
	5 & 6/4	"	44.02	44.02	45.10	46.62	48.27	47.66	- - -	
	8/4+	"	- - -	- - -	- - -	- - -	- - -	- - -	- - -	52.91
No. 1 Com.	4/4	15.80	38.40	39.13	39.87	40.70	45.34	45.34	45.34	
	5/4+	"	"	"	"	"	"	"	"	
No. 2 Com.	4/4	"	28.56	29.80	27.09	27.32	30.98	30.98	30.98	
	5/4+	"	"	"	"	"	"	"	"	
No. 3 Com.	4/4	"	20.28	22.06	21.09	20.73	20.53	23.10	23.10	
	5/4+	"	"	"	"	"	"	"	"	
No. 4 Com.	4/4+	"	- - -	- - -	- - -	- - -	- - -	- - -	- - -	16.43
No. 5 Com.	4/4+	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	10.64

ALL WIDTHS AND LENGTHS

No. 3 Clear	4/4	37.53	Box	4/4	15.00
Inch Shop	4/4	21.94		5/4+	"
No.3 Clr.Thick	5&6/4	47.63	No.2 Box	4/4	13.00
	8/4+	60.71		5/4+	"
No. 1 Shop	5&6/4	36.00	Cull Box	4/4	7.50
	8/4+	45.54		5/4+	"
No. 2 Shop	5&6/4	24.51			
	8/4+	27.94			
No. 3 Shop	5&6/4	18.46			
	8/4	18.90			
Australian	4/4	32.89			
	5&6/4	"			
	8/4+	"			
Molding	4/4	30.00			
	5&6/4	33.30			
	8/4	"			

Table 4.- ACTUAL SURFACED LUMBER GRADES PRODUCED FROM LOGS OF DIFFERENT DIAMETERS
GRADE 1 PONDEROSA PINE LOGS
1939 BLACKS MOUNTAIN STUDY SITE INDEX 112

Lumber grade	Four inch log diameter group							
	14-17	18-21	22-25	26-29	30-33	34-37	38-41	42-45
	Percent of total lumber tally							
No. 1 & 2 Clear	-	-	1.5	0.7	3.3	3.7	9.8	3.2
C Select	7.5	5.1	7.4	8.7	15.4	15.3	7.9	30.1
D Select	7.7	9.0	12.6	11.1	12.4	9.5	14.9	22.7
Short Select	1.4	0.1	1.6	2.1	1.1	1.2	0.9	0.1
Sub-total Select	16.6	14.2	23.1	22.6	32.2	29.7	24.5	56.1
Australian	1.9	-	-	-	0.6	1.4	5.1	11.0
Molding	-	1.9	0.4	1.3	3.7	4.0	7.6	1.6
Sub-total Molding & better	18.5	16.1	23.5	23.9	36.5	35.1	37.2	68.7
Thick No. 3 Clear	-	-	-	-	-	-	1.1	-
4/4 No. 3 Clear	6.3	6.0	10.3	7.4	6.8	4.6	3.4	3.3
No. 1 Shop	-	-	-	-	3.0	2.3	1.3	-
No. 2 Shop	-	-	1.9	3.4	8.2	7.6	5.2	2.9
Sub-total No. 2 Shop & better	25.3	22.1	35.7	34.7	54.5	50.0	48.2	74.9
No. 1 Common	-	-	-	-	-	-	-	-
No. 2 Common	6.2	0.9	2.3	2.4	0.9	0.6	-	-
Sub-total No.2 Common & better	31.5	23.0	38.0	37.1	55.4	50.6	48.2	74.9
No. 3 Shop	8.8	5.9	4.2	10.0	5.0	11.2	7.6	1.4
Inch Shop	4.3	6.1	9.3	4.5	2.0	2.3	2.4	0.5
No. 3 Common	-	6.0	5.3	-	0.2	0.3	0.3	-
Sub-total No.3 Common & better	44.6	41.0	56.3	51.6	62.6	64.4	58.5	76.8
No. 4 Common	-	2.8	4.6	-	0.5	-	0.9	-
Box, No. 2 Box & Cull Box	55.4	56.2	40.1	48.4	36.9	35.6	40.6	23.2
No. 5 Common	-	-	-	-	-	-	-	-
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Basis, actual number of logs	4	8	8	6	9	9	5	2
Tally, ft. b. m.	432.8	1400.7	1915.5	2184.4	6065.1	7019.5	5024.2	2365.6
Average diameter inside bark	15.8	19.8	23.0	26.3	31.4	35.3	39.6	44.0
Gross scale, board feet	470	1510	2080	2560	6490	7590	5630	2730
Net scale, board feet	470	1510	2080	2480	6300	7560	5390	2640
Overrun, percent, gross scale	+2.7	-7.2	-7.9	-14.7	-6.5	-7.5	-10.8	-13.7
Overrun, percent, net scale	+2.7	-7.2	-7.9	-11.9	-3.7	-7.0	-6.6	-10.8
Cull percent	-	-	-	3.1	2.9	0.5	4.4	3.3
Value per M.B.M. by Schedule B	23.10	22.48	27.86	27.25	33.83	32.78	29.93	45.55
Value per M.B.M. by Schedule A	23.60	21.98	25.80	25.46	30.18	29.34	26.53	39.23
Value per M Gr.Sc.by Schedule B	23.75	20.85	25.47	23.28	31.62	30.32	26.71	39.30
Value per M Gr.Sc.by Schedule A	24.24	20.39	23.35	21.72	28.20	27.13	23.67	33.85

Table 5.- ACTUAL SURFACED LUMBER GRADES PRODUCED FROM LOGS OF DIFFERENT DIAMETERS
GRADE 2 PONDEROSA PINE LOGS
1939 BLACKS MOUNTAIN STUDY SITE INDEX 112

Lumber grade	Four inch log diameter group							
	10-13	14-17	18-21	22-25	26-29	30-33	34-37	38-41
	Percent of total lumber tally							
No. 1 & 2 Clear	-	-	0.8	1.0	0.6	0.9	-	-
C Select	-	-	4.2	5.3	1.5	1.9	2.5	5.3
D Select	-	3.0	8.5	4.9	2.0	2.6	11.8	3.7
Short Select	-	2.3	0.8	1.4	0.5	-	0.6	1.0
Sub-total select	-	5.3	14.3	12.6	4.6	5.4	14.9	10.0
Australian	-	-	-	-	-	-	0.6	-
Molding	-	-	1.4	0.8	0.8	0.6	5.1	4.3
Sub-total Molding & better	-	5.3	15.7	13.4	5.2	6.0	20.8	14.3
Thick No. 3 Clear	-	-	1.3	-	-	-	-	-
4/4 No. 3 Clear	-	10.2	3.4	8.2	5.3	4.6	5.7	1.3
No. 1 Shop	-	-	-	-	10.5	5.8	-	-
No. 2 Shop	-	7.9	-	2.1	21.8	26.4	3.8	30.3
Sub-total No. 2 Shop & better	-	23.4	20.4	23.7	42.8	42.8	30.3	45.9
No. 1 Common	-	-	-	-	-	-	-	-
No. 2 Common	-	-	-	-	2.8	-	-	3.2
Sub-total No.2 Common & better	-	23.4	20.4	23.7	45.6	42.8	30.3	49.1
No. 3 Shop	-	9.9	5.2	7.1	8.2	14.0	21.1	13.7
Inch Shop	-	8.1	4.9	7.1	4.8	2.7	6.0	7.4
No. 3 Common	5.8	4.0	1.2	4.8	5.4	9.0	-	10.9
Sub-total No.3 Common & better	5.8	45.4	31.7	42.7	64.0	68.5	57.4	81.1
No. 4 Common	-	-	2.8	2.8	5.5	3.3	-	2.9
Box,No.2 Box, Cull Box	94.2	54.6	65.5	54.0	30.1	26.3	42.6	9.6
No. 5 Common	-	-	-	0.5	0.4	1.9	-	6.4
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Basis, actual number of logs	1	1	6	4	7	3	3	1
Tally, ft. b. m.	69.0	176.5	1504.1	1256.5	3856.5	2159.8	2473.1	753.7
Average diameter inside bark	13.0	17.0	19.7	23.2	27.6	32.7	36.0	38.0
Gross scale, board feet	70	180	1590	1410	4110	2110	2660	800
Net scale, board feet	70	180	1590	1370	4000	2110	2640	800
Overrun,percent,gross scale	-1.4	-1.9	-5.4	-10.9	-6.2	+2.4	-7.0	-5.8
Overrun,percent, net scale	-1.4	-1.9	-5.4	- 8.3	-3.6	+2.4	-6.3	-5.8
Cull percent	-	-	-	2.8	2.7	-	0.8	-
Value per M B.M.by Schedule B	13.43	20.09	21.81	22.15	24.84	24.18	24.26	26.14
Value per M B.M.by Schedule A	11.83	19.73	21.46	21.24	22.14	22.23	22.02	23.68
Val.per M Gr.Sc.by Schedule B	13.24	19.70	20.63	19.74	23.51	24.75	22.55	24.62
Val.per M Gr.Sc.by Schedule A	11.66	19.35	20.29	18.92	20.78	22.75	20.47	22.31

Table 6.-ACTUAL SURFACED LUMBER GRADES PRODUCED FROM LOGS OF DIFFERENT DIAMETERS GRADE 5 PONDEROSA PINE LOGS 1939 BLACKS MOUNTAIN STUDY SITE INDEX 112

Lumber grade	Four inch log diameter group								
	10-13	14-17	18-21	22-25	26-29	30-33	34-37	38-41	42-45
	Percent of total lumber tally								
No. 1 & 2 Clear	-	-	-	-	5.1	-	0.6	-	-
C Select	-	-	-	3.8	7.1	1.7	2.8	3.1	14.3
D Select	-	2.4	2.7	5.3	2.4	3.0	-	3.7	5.6
Short Select	-	1.1	0.4	-	0.6	0.5	0.3	0.6	0.7
Sub-total select	-	3.5	3.1	9.1	15.2	5.2	3.7	7.4	20.6
Australian	-	-	-	-	-	-	-	0.3	-
Molding	-	-	0.6	4.4	0.2	-	2.8	4.1	2.1
Sub-total Molding and better	-	3.5	3.7	13.5	15.4	-	6.5	11.8	22.7
Thick No. 3 Clear	-	-	-	-	-	1.3	-	-	-
4/4 No. 3 Clear	-	0.5	4.7	-	1.1	4.1	0.4	1.2	1.5
No. 1 Shop	-	-	-	-	-	8.5	-	2.1	-
No. 2 Shop	-	1.8	6.6	25.0	19.6	8.3	18.1	34.9	34.6
Sub-total No. 2 Shop & better	-	5.8	15.0	38.5	36.1	28.4	25.0	50.0	59.0
No. 1 Common	-	-	-	-	-	-	-	-	-
No. 2 Common	-	5.2	4.1	3.8	0.9	2.4	-	0.3	1.9
Sub-total No.2 Common & better	-	11.0	19.1	42.3	37.0	30.8	25.0	50.3	60.9
No. 3 Shop	-	-	20.7	7.8	17.1	16.1	31.0	19.8	26.3
Inch Shop	7.6	1.6	5.6	12.1	4.6	7.6	3.1	6.2	-
No. 3 Common	3.0	11.4	3.6	15.2	1.4	8.2	1.0	2.6	0.5
Sub-total No.3 Common & better	10.6	23.9	48.9	77.2	60.0	62.7	60.1	78.9	87.7
No. 4 Common	2.8	1.3	4.8	11.4	5.3	4.8	0.8	1.4	-
Box, No. 2 Box & Cull Box	86.6	74.8	46.2	7.6	34.1	32.5	39.4	19.7	12.3
No. 5 Common	-	-	-	3.8	0.6	-	-	-	-
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Basis, actual number of logs	2	8	3	1	4	4	3	4	1
Tally, ft. b. m.	175.6	1078.5	971.9	315.7	2223.5	2549.8	2787.4	4363.5	1519.8
Average diameter inside bark	12.0	15.8	20.7	25.0	27.8	32.0	35.3	38.5	44.0
Gross scale, board feet	140	1100	880	340	2270	2680	2680	4380	1690
Net scale, board feet	140	1060	880	340	2270	2680	2680	4380	1690
Overrun, percent, gross scale	+25.4	-2.0	+10.4	-7.1	-2.0	-4.9	+4.0	-0.4	-10.1
Overrun, percent, net scale	+25.4	+2.7	+10.4	-7.1	-2.0	-4.9	+4.0	-0.4	-10.1
Cull percent	-	4.5	-	-	-	-	-	-	-
Value per M B.M. by Schedule B	15.29	16.69	19.42	25.19	25.96	23.51	20.74	25.02	29.12
Value per M B.M. by Schedule A	15.23	16.77	18.37	22.76	23.69	21.13	19.37	22.68	27.50
Value per M Gr.Sc. by Schedule B	19.18	16.36	21.48	23.39	25.42	22.37	21.57	24.98	26.18
Value per M Gr.Sc. by Schedule A	19.17	16.44	20.28	21.13	23.20	20.11	20.14	22.60	24.73

Table 7.-ACTUAL SURFACED LUMBER GRADES PRODUCED FROM LOGS OF DIFFERENT DIAMETERS
GRADE 4 PONDEROSA PINE LOGS
1939 BLACKS MOUNTAIN STUDY SITE INDEX 112

Lumber grade	Four inch log diameter group									
	6-9	10-13	14-17	18-21	22-25	26-29	30-33	34-37	38-41	42-45
	Percent of total lumber tally									
No. 1 & 2 Clear	-	-	-	-	-	1.0	-	-	-	-
C Select	-	-	0.4	0.4	0.7	0.5	1.4	1.0	-	1.8
D Select	-	0.8	0.8	0.1	1.0	1.7	1.0	0.9	-	0.9
Short Select	2.3	0.2	0.2	0.6	0.7	0.5	0.3	0.8	-	-
Sub-total Select	2.3	1.0	1.4	1.0	2.4	3.7	2.7	2.6	-	2.7
Australian	-	-	-	-	-	-	-	-	-	-
Molding	-	1.0	-	1.2	0.3	0.5	0.2	0.2	-	-
Sub-total Molding and Better	2.3	2.0	1.4	2.2	2.7	4.2	2.9	2.7	-	2.7
Thick No. 3 Clear	-	-	0.6	-	-	-	0.5	-	-	-
4/4 No. 3 Clear	-	4.7	2.3	3.3	5.0	3.2	2.2	1.4	-	1.1
No. 1 Shop	-	-	0.4	-	0.8	10.9	2.6	5.7	-	17.8
No. 2 Shop	-	-	4.9	5.2	9.7	23.2	20.3	24.5	-	45.9
Sub-total No. 2 Shop & Better	2.3	6.7	9.6	10.7	18.2	41.5	28.4	34.3	-	67.5
No. 1 Common	5.4	2.6	-	-	-	0.5	-	-	-	0.9
No. 2 Common	11.1	10.6	11.3	5.8	3.5	1.8	3.0	2.4	-	4.8
Sub-total No. 2 Common & Better	18.8	20.0	20.9	16.5	19.7	43.8	31.4	36.7	-	73.2
No. 3 Shop	-	1.4	5.9	16.9	16.8	17.8	25.8	23.5	-	10.5
Inch Shop	-	1.9	2.9	5.7	8.0	4.9	5.8	3.4	-	2.0
No. 3 Common	-	6.1	10.3	9.3	13.3	2.1	2.2	2.2	-	5.9
Sub-total No. 3 Common & Better	18.8	29.4	39.1	48.4	57.8	68.6	65.2	65.8	-	91.6
No. 4 Common	3.1	4.5	4.4	6.3	5.9	1.0	2.2	1.4	-	5.0
Box, No. 2 Box, & Cull Box	78.1	66.1	55.0	41.9	34.4	29.9	33.6	32.8	-	5.4
No. 5 Common	-	-	1.5	1.4	1.9	0.5	1.0	-	-	-
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	-	100.0
Basis, actual number of logs	5	12	16	14	14	6	11	6	-	2
Tally, ft. b. m.	128.8	848.1	2039.1	3586.9	5040.8	3068.8	6833.7	5103.7	-	2603.4
Average diameter inside bark	9.0	11.8	15.2	19.6	23.5	28.2	31.2	35.5	-	42.0
Gross scale, board feet	100	780	1930	3490	5350	3340	7020	5000	-	2680
Net scale, board feet	100	780	1930	3490	5350	3340	6850	4800	-	2680
Overrun, percent, gross scale	+28.8	+8.5	+8.7	+1.9	-5.8	-8.3	-2.7	+2.1	-	-2.9
Overrun, percent, net scale	+28.8	+8.5	+8.7	+1.9	-5.8	-8.3	-0.2	+6.3	-	-2.9
Cull percent	-	-	-	-	-	-	2.4	4.0	-	-
Value per M B.M. by Schedule B	17.31	18.33	18.86	18.92	19.97	24.57	21.27	22.51	-	29.49
Value per M B.M. by Schedule A	16.75	18.34	18.61	18.45	19.19	22.10	19.69	20.34	-	25.23
Value per M Gr.Sc. by Schedule B	22.30	19.88	20.12	19.28	18.82	22.54	20.71	22.78	-	28.64
Value per M Gr.Sc. by Schedule A	21.68	19.89	20.07	18.80	18.08	20.28	19.17	20.77	-	24.51

Table 8.- ACTUAL SURFACED LUMBER GRADES PRODUCED FROM LOGS OF DIFFERENT DIAMETERS
GRADE C PONDEROSA PINE LOGS
1989 BLACKS MOUNTAIN STUDY SITE INDEX 112

Lumber grade	Four inch log diameter group			
	6-9	10-13	14-17	18-21
	Percent of total lumber tally			
No. 1 & 2 Clear	-	-	-	-
C Select	-	1.5	1.0	-
D Select	-	-	1.4	-
Short Select	-	0.3	-	1.1
Sub-total Select	-	1.8	2.4	1.1
Australian	-	-	-	-
Molding	-	-	1.3	-
Sub-total Molding and Better	-	1.8	3.7	1.1
Thick No. 3 Clear	-	-	-	-
4/4 No. 3 Clear	-	-	1.2	-
No. 1 Shop	-	-	-	-
No. 2 Shop	-	-	5.5	7.3
Sub-total No. 2 Shop and Better	-	1.8	10.4	8.4
No. 1 Common	-	8.6	2.0	-
No. 2 Common	-	6.5	18.4	7.3
Sub-total No. 2 Common & Better	-	16.9	30.8	15.7
No. 3 Shop	-	1.9	1.4	-
Inch Shop	-	-	1.1	-
No. 3 Common	3.7	8.3	13.1	48.5
Sub-total No. 3 Common & Better	3.7	27.1	46.4	64.2
No. 4 Common	2.9	3.9	2.8	-
Box, No. 2 Box & Cull Box	93.4	67.2	50.8	21.1
No. 5 Common	-	1.8	-	14.7
Total	100.0	100.0	100.0	100.0
Basis, actual number of logs	6	9	7	1
Tally, ft. b. m.	280.9	469.9	988.6	218.0
Average diameter inside bark	9.0	10.9	15.3	18.0
Gross scale, board feet	200	460	930	210
Net scale, board feet	200	460	930	210
Overrun, percent, gross scale	+40.4	+2.2	+6.3	+3.8
Overrun, percent, net scale	+40.4	+2.2	+6.3	+3.8
Cull percent	-	-	-	-
Value per M B.M. by Schedule B	13.19	18.20	20.08	19.03
Value per M B.M. by Schedule A	11.88	17.72	20.15	18.92
Value per M Cr.Sc. by Schedule B	18.53	18.59	21.35	19.76
Value per M Cr.Sc. by Schedule A	16.69	18.10	21.42	19.64

Table 9.- ACTUAL SURFACED LUMBER GRADES PRODUCED FROM LOGS OF DIFFERENT DIAMETERS
GRADES 4 AND C COMBINED PONDEROSA PINE LOGS
1939 BLACKS MOUNTAIN STUDY SITE INDEX 112

Lumber grade	Four inch log diameter group									
	6-9	10-13	14-17	18-21	22-25	26-29	30-33	34-37	38-41	42-45
	Percent of total lumber tally									
No. 1 & 2 Clear	-	-	-	-	-	1.0	-	-	-	-
C Select	-	0.5	0.6	0.4	0.7	0.5	1.4	1.0	-	1.8
D Select	-	0.5	1.0	0.1	1.0	1.7	1.0	0.9	-	0.9
Short Select	0.7	0.3	0.2	0.5	0.7	0.5	0.3	0.6	-	-
Sub-total Select	0.7	1.3	1.8	1.0	2.4	3.7	2.7	2.5	-	2.7
Australian	-	-	-	-	-	-	-	-	-	-
Molding	-	0.6	0.4	1.2	0.3	0.5	0.2	0.2	-	-
Sub-total Molding and Better	0.7	1.9	2.2	2.2	2.7	4.2	2.9	2.7	-	2.7
Thick No. 3 Clear	-	-	0.4	-	-	-	0.5	-	-	-
4/4 No. 3 Clear	-	3.1	2.0	3.1	5.0	3.2	2.2	1.4	-	1.1
No. 1 Shop	-	-	0.3	-	0.8	10.9	2.5	5.7	-	17.8
No. 2 Shop	-	-	5.1	5.3	9.7	23.2	20.3	24.5	-	45.9
Sub-total No. 2 Shop and Better	0.7	5.0	10.0	10.6	18.2	41.5	28.4	34.3	-	67.5
No. 1 Common	1.7	4.9	0.7	-	-	0.5	-	-	-	0.9
No. 2 Common	3.5	9.1	13.6	5.9	3.5	1.8	3.0	2.4	-	4.8
Sub-total No. 2 Common & Better	5.9	19.0	24.3	16.5	19.7	43.8	31.4	36.7	-	73.2
No. 3 Shop	-	1.6	4.4	15.9	16.3	17.8	25.8	23.5	-	10.5
Inch Shop	-	1.2	1.7	5.3	8.0	4.9	3.9	3.4	-	2.0
No. 3 Common	2.5	6.9	11.2	11.5	13.3	2.1	2.2	2.2	-	5.9
Sub-total No. 3 Common & Better	8.4	28.7	41.6	49.2	57.8	68.6	63.2	65.8	-	91.6
No. 4 Common	2.9	4.3	3.9	7.8	5.9	1.0	2.2	1.4	-	3.0
Box, No. 2 Box, & Cull Box	88.7	66.4	53.5	40.8	34.4	29.9	33.6	32.8	-	5.4
No. 5 Common	-	0.6	1.0	2.2	1.9	0.5	1.0	-	-	-
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	-	100.0
Basis, actual number of logs	9	21	23	15	14	6	11	6	-	2
Tally, ft. b. m.	409.7	1316.0	3047.7	5774.9	5040.8	3063.8	6833.7	5108.7	-	2603.4
Average diameter inside bark	9.0	11.4	15.3	19.5	23.5	28.2	31.2	35.5	-	42.0
Gross scale, board feet	300	1240	2860	5700	5350	3340	7020	5000	-	2880
Net scale, board feet	300	1240	2860	5700	5350	3340	6850	4800	-	2880
Overrun, percent, gross scale	+36.6	+6.1	+6.6	+2.0	-5.8	-8.3	-2.7	+2.1	-	-2.9
Overrun, percent, net scale	+36.6	+6.1	+6.6	+2.0	-5.8	-8.3	-0.2	+6.3	-	-2.9
Cull percent	-	-	-	-	-	-	2.4	4.0	-	-
Value per M B.M. by Schedule B	14.49	18.28	19.25	18.98	19.97	24.57	21.27	22.31	-	29.49
Value per M B.M. by Schedule A	13.41	18.12	19.24	18.48	19.19	22.10	19.69	20.34	-	25.25
Value per M Gr.Sc.by Schedule B	19.79	19.40	20.52	19.51	18.82	22.54	20.71	22.78	-	28.64
Value per M Gr.Sc.by Schedule A	18.32	19.23	20.51	18.85	18.08	20.28	19.17	20.77	-	24.61

Table 10.- ACTUAL SURFACED LUMBER GRADES PRODUCED FROM LOGS OF DIFFERENT DIAMETERS
GRADE 5 PONDEROSA PINE LOGS
1939 BLACKS MOUNTAIN STUDY SITE INDEX 112

Lumber grade	Four inch log diameter group								
	6-9	10-13	14-17	18-21	22-25	26-29	30-33	34-37	38-41
	Percent of total lumber tally								
No. 1 & 2 Clear	-	-	-	-	-	-	0.1	-	-
C Select	-	0.2	-	0.2	0.8	0.1	0.6	-	1.0
D Select	-	0.8	-	0.4	0.7	0.5	0.8	0.6	-
Short Select	-	0.8	0.8	0.5	0.5	0.4	0.3	0.3	-
Sub-total Select		1.0	0.3	1.1	1.8	1.0	1.8	0.9	1.0
Australian	-	-	-	-	-	-	-	-	-
Molding	-	-	0.8	0.4	0.8	-	0.2	0.1	-
Sub-total Molding and Better		1.0	0.6	1.5	2.3	1.0	1.5	1.0	1.0
Thick No. 3 Clear	-	-	-	-	0.2	0.4	0.3	-	-
4/4 No. 3 Clear	-	0.2	0.8	0.7	1.1	2.9	1.4	0.6	1.7
No. 1 Shop	-	-	-	-	0.2	1.0	0.8	1.2	7.8
No. 2 Shop	-	1.3	1.1	2.7	9.7	15.4	20.7	21.9	46.2
Sub-total No. 2 Shop & Better		2.5	2.0	4.9	13.8	20.7	24.7	24.7	56.2
No. 1 Common	-	0.4	0.4	-	0.7	0.2	-	-	-
No. 2 Common	5.8	9.2	5.8	5.8	2.5	4.6	2.1	1.1	-
Sub-total No. 2 Common & Better	5.8	12.1	6.2	10.7	16.7	25.5	26.8	25.8	56.2
No. 3 Shop	-	1.6	6.5	12.2	20.8	22.1	23.2	30.7	11.9
Inch Shop	-	1.2	1.5	1.1	2.6	3.9	2.4	2.3	8.6
No. 3 Common	5.8	9.9	3.6	11.6	4.0	5.0	1.7	0.5	-
Sub-total No. 3 CommonBetter	11.6	24.8	19.6	35.6	43.9	56.5	54.1	59.3	76.7
No. 4 Common	5.8	2.2	1.7	5.5	2.4	1.8	0.9	0.9	-
Box, No. 2 Box, & Cull Box	82.6	71.8	78.1	58.1	53.0	41.9	44.5	39.9	23.3
No. 5 Common	-	1.2	0.6	0.8	0.7	0.3	0.5	-	-
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Basis, actual number of logs	5	25	26	25	26	20	15	10	1
Tally, ft. b. m.	86.2	1906.5	3998.4	5281.2	9498.8	9601.5	8868.8	8195.7	1112.0
Average diameter inside bark	8.7	11.8	16.7	19.5	23.5	27.4	31.5	35.5	41.0
Gross scale, board feet	80	1650	3520	6030	9590	9870	8950	8370	1270
Net scale, board feet	80	1650	3500	6030	9690	9790	8710	8150	1270
Overrun, percent, gross scale	+7.8	+15.5	+13.6	+3.7	-1.0	-2.7	-0.9	-2.1	-12.4
Overrun, percent, net scale	+7.8	+15.5	+14.2	+3.7	-1.0	-1.9	+1.8	+0.5	-12.4
Cull percent	-	-	0.8	-	-	0.8	2.7	2.6	-
Value per M B.M. by Schedule B	13.75	16.19	15.86	17.24	18.10	19.74	19.47	19.30	25.91
Value per M B.M. by Schedule A	13.25	16.40	15.72	17.02	17.44	18.63	18.04	18.00	21.69
Value per M Gr.Sc.bySchedule B	14.81	18.70	18.01	17.87	17.92	19.21	19.80	18.89	20.93
Value per M Gr.Sc.bySchedule A	14.25	18.94	17.85	17.65	17.27	18.12	17.88	17.62	18.99

Table 11.- ACTUAL SURFACED LUMBER GRADES PRODUCED FROM LOGS OF DIFFERENT DIAMETERS GRADE 6 PONDEROSA PINE LOGS 1939 BLACKS MOUNTAIN STUDY SITE INDEX 112

Lumber grade	Four inch log diameter group						
	6-9	10-13	14-17	18-21	22-25	26-29	30-33
	Percent of total lumber tally						
No. 1 & 2 Clear	-	-	-	-	-	-	-
C Select	-	-	-	0.3	-	-	-
D Select	-	-	0.2	0.3	-	-	-
Short Select	-	0.3	-	0.2	0.4	-	0.7
Sub-total Select	-	0.3	0.2	0.8	0.4	-	0.7
Australian	-	-	-	-	-	-	-
Molding	-	-	-	-	0.4	-	-
Sub-total Molding and Better	-	0.3	0.2	0.8	0.8	-	0.7
Thick No. 3 Clear	-	-	-	-	-	-	-
4/4 No. 3 Clear	-	0.6	0.1	-	0.6	0.4	-
No. 1 Shop	-	-	-	-	0.9	-	-
No. 2 Shop	-	0.7	1.7	1.6	6.7	3.5	4.5
Sub-total No. 2 Shop and Better	-	1.6	2.0	2.4	8.9	3.9	5.2
No. 1 Common	-	-	-	-	0.7	-	-
No. 2 Common	-	-	0.5	0.8	2.0	0.8	0.9
Sub-total No. 2 Common & Better	-	1.6	2.5	3.2	11.6	4.7	6.1
No. 3 Shop	-	0.9	1.0	7.1	18.8	23.6	16.5
Inch Shop	-	0.3	0.4	0.6	1.0	2.6	2.0
No. 3 Common	3.8	1.5	3.7	0.6	3.9	6.4	0.9
Sub-total No. 3 Common & Better	3.8	4.3	7.8	11.3	35.3	37.3	25.5
No. 4 Common	-	0.2	0.7	0.4	2.1	1.8	0.8
Box, No. 2 Box & Cull Box	96.2	94.8	91.5	88.1	62.2	60.1	73.9
No. 5 Common	-	0.7	0.2	-	0.5	0.8	0.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Basis, actual number of logs	3	18	16	11	9	4	4
Tally, ft. b. m.	155.0	1446.5	2506.7	2386.8	3525.1	2045.2	2391.6
Average diameter inside bark	8.3	11.5	15.7	18.9	23.9	28.0	31.0
Gross scale, board feet	90	1120	2160	2450	3580	2320	2550
Net scale, board feet	90	1120	2140	2450	3480	2320	2510
Overrun, percent, gross scale	+72.2	+29.2	+16.1	-2.6	-0.7	-11.8	-6.6
Overrun, percent, net scale	+72.2	+29.2	+17.1	-2.6	+2.2	-11.8	-5.1
Cull percent	-	-	0.9	-	2.8	-	1.6
Value per M B.M. by Schedule B	15.40	15.47	14.57	14.23	16.50	15.68	14.79
Value per M B.M. by Schedule A	15.07	15.19	15.97	15.76	15.69	15.26	14.20
Value per M Gr.Sc. by Schedule B	23.08	17.40	16.67	13.86	16.38	14.00	13.81
Value per M Gr.Sc. by Schedule A	22.51	17.03	16.21	13.40	15.48	13.46	13.26

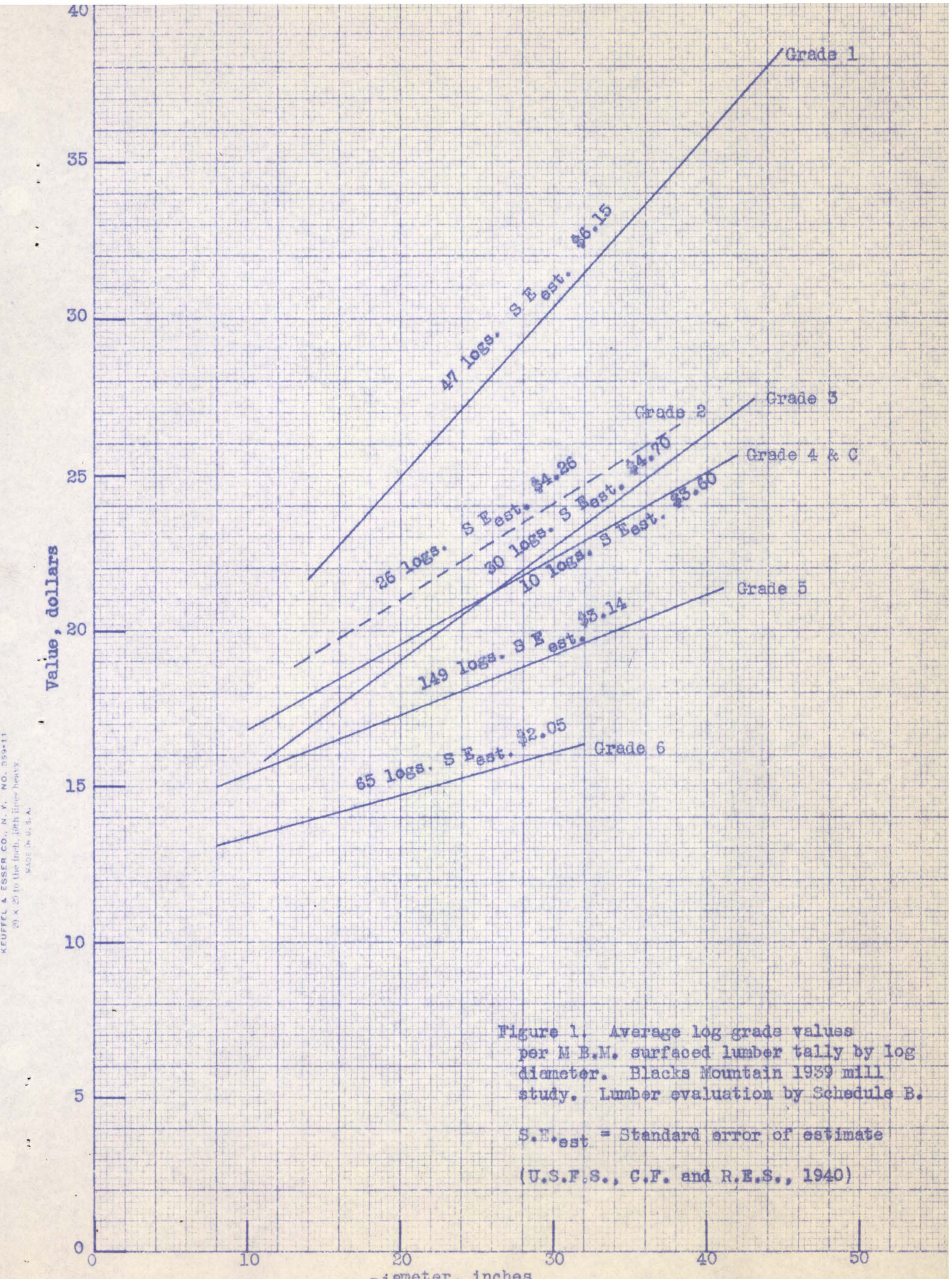


Figure 1. Average log grade values per M B.M. surfaced lumber tally by log diameter. Blacks Mountain 1939 mill study. Lumber evaluation by Schedule B.

$S.E._{est}$ = Standard error of estimate

(U.S.F.S., C.F. and R.E.S., 1940)

It is notable that the lower grade logs are subject to less error in estimating than the higher grades. The chances are 68 in a 100 that a 30 inch grade 6 log in this particular stand will produce lumber at an actual value within $2.05 of $16.05. It is inevitable that logs with large numbers of knots will be classified more accurately for evaluation purposes than will clear logs whose interior knot patterns are more obscure. It follows that to obtain value-diameter relationship lines for value prediction a much larger sample is needed for grade 1 logs than for the lower grades.

Trees - Individual tree values per M b. f. were obtained by adding weighted individual log values. While the log analysis includes all study logs that were run through the mill, the tree analysis excludes 16 trees which were only partially recovered or whose field data did not permit accurate reconstruction.

Tables 12 to 16 present tree values per M b.f. and average measurements by insect risk classes and 4 inch diameter groups. Figure 2 illustrates the average relationship of value per M net scale to tree diameter by least squares calculation. Here as in the log analysis the dispersion of the individual values is so great that no significant curvilinear relationship could be detected although it is probable that sufficiently large samples would yield curve forms.

The correlation coefficients for insect risk classes 1, 2 and 3 are statistically significant, while for class 4 the chances are greater than 5 in 100 that no correlation of value with diameter should be indicated. The sample in class 4 is so small and the dispersion of the individual tree value is so great that reasonable reliance may not be placed upon the correlation.

It may be noted that the dispersion of individual tree values about the regression lines (as indicated by the standard error of estimate) are great enough to indicate an overlapping of dispersion bands between classes. This raises the question whether the classes are significantly different in value. Classes 1, 2 and 3 may be compared by testing the significance of the variance of the estimated values at the average diameter of the trees in the three classes. Class 4 may not be included in this analysis. Below is given the results of the analysis where the average diameter is 30.86 inches and the corresponding estimated values are Class 1, $22.09, Class 2, $20.36, and Class 3, $18.77.

Comparison	Difference between values	Standard error of difference	Degrees of freedom	t	
	dollars	dollars			
Class 1, Class 2	22.10 - 20.32 = 1.78	.944	54	1.89	not sig.
Class 2, Class 3	20.32 - 18.43 = 1.89	1.13	44	1.67	not sig.
Class 1, Class 3	22.10 - 18.43 = 3.67	1.20	54	3.06	highly sig.

Table 12.- **Average tree measurements and values of insect Risk Class 1 by four inch diameter groups.**

	Four inch tree d.b.h. groups										
	14-17	18-21	22-25	26-29	30-33	34-37	38-41	42-45	46-49	50-53	All groups
Number of trees	2	3	2	4	3	4	3	1	1	1	24
Average d.b.h. (inches)	15.6	18.5	23.1	26.8	31.0	34.8	39.6	42.1	48.5	52.1	30.5
Average surfaced tally (feet b.m.)	106	229	469	943	965	1863	2884	2955	4703	6740	1625
Average gross scale board feet 1/	85	217	445	860	963	1828	2913	3130	4670	7090	1624
Average net scale board feet	85	217	445	860	963	1800	2840	3130	4660	7040	1608
Overrun, percent, gross scale	+24.7	+5.9	+5.3	+9.6	+0.2	+2.0	-1.0	-5.6	+0.7	-4.9	+0.1
Overrun, percent, net scale	+24.7	+5.9	+5.3	+9.6	+0.2	+3.5	+1.6	-5.6	+0.9	-4.3	+1.1
Cull percent	-	-	-	-	-	1.5	2.5	-	0.2	0.7	1.0
Value per M b.m., Schedule B (dollars)	16.31	17.29	18.55	21.76	17.20	20.85	29.82	21.84	22.72	28.46	24.13
Value per M gr. sc. Schedule B (dollars)	20.34	18.31	19.54	23.85	17.23	21.26	29.52	20.62	22.88	27.05	24.15
Value per M net sc. Schedule B (dollars)	20.34	18.31	19.54	23.85	17.23	21.58	30.28	20.62	22.92	27.24	24.39

1/ Based on merchantable top diameter.

Table 13.- Average tree measurements and values of insect Risk Class 2 by four inch diameter groups

	Four inch trees d.b.h. groups											
	10-13	14-17	18-21	22-25	26-29	30-33	34-37	38-41	42-45	46-49	50-53	All groups
Number of trees	2	4	5	4	3	5	2	6	2	2	1	34
Average d.b.h.(inches)	12.0	16.0	19.3	23.9	27.7	31.4	35.7	39.5	44.0	46.1	50.5	30.0
Average surf.tally, (feet b.m.)	31	89	367	670	790	1210	1736	2984	3618	3505	5217	1572
Average gr. scale board feet 1/	35	100	363	643	807	1234	2005	2997	3880	3865	5420	1636
Average net scale (board feet)	35	100	363	643	807	1234	1775	2933	3315	3315	5360	1544
Overrun,percent,gr.scale	-10.3	-11.0	+0.9	+4.3	-2.1	-1.9	-13.4	-0.4	-6.7	-9.3	-5.7	-3.9
Overrun,percent,net scale	-10.3	-11.0	+0.9	+4.3	-2.1	-1.9	- 2.2	+1.7	+9.2	+5.7	-2.7	+1.8
Cull percent	-	-	-	-	-	-	11.5	2.1	14.6	14.2	1.1	5.6
Value per M b.m.Sched. B (dollars)	16.56	15.79	20.58	18.34	19.18	21.04	20.34	22.28	22.72	22.68	29.72	22.43
Value per M gr.sc.Sched.B (dollars)	14.86	14.05	20.77	19.12	18.77	20.64	17.60	22.19	21.19	20.57	28.61	21.56
Value per M net sc.Sched.B (dollars)	14.86	14.05	20.77	19.12	18.77	20.64	19.89	22.67	24.80	23.98	28.93	22.85

1/ Based on merchantable top diameter.

Table 14.- Average tree measurements and values of insect Risk Class 3 by four inch diameter groups.

	Four inch tree d.b.h. groups										
	14-17	18-21	22-25	26-29	30-33	34-37	38-41	42-45	46-49	50-53	All groups
Number of trees	1	1	3	-	2	1	3	1	1	1	14
Average d.b.h. (inches)	17.0	19.8	25.0	-	31.9	33.9	39.4	42.5	45.8	51.8	33.4
Average surfaced tally, (feet b.m.)	197	199	851	-	1450	1506	2673	3034	2520	5139	1968
Average gross scale board feet 1/	200	240	857	-	1555	1730	2777	3150	2890	5110	1952
Average net scale board feet	200	210	810	-	1555	1650	2773	3150	2760	5110	1924
Overrun, percent, gross scale	-1.4	-17.2	-0.6	-	-6.8	-8.3	-3.7	-3.7	-12.8	+0.6	-4.3
Overrun, percent, net scale	-1.4	- 5.3	+5.1	-	-6.8	-3.9	-3.6	-3.7	- 8.7	+0.6	-2.9
Cull percent	-	12.5	5.4	-	-	4.6	0.1	-	4.5	-	1.4
Value per M b.m., Schedule B (dollars)	16.65	16.44	17.72	-	20.83	24.06	19.86	19.67	22.45	22.96	20.80
Value per M gr. sc. Sched. B (dollars)	16.40	15.62	17.61	-	19.42	22.06	19.11	18.95	19.58	23.09	19.90
Value per M net sc. Sched. B (dollars)	16.40	15.57	18.62	-	19.42	23.12	19.14	18.95	20.50	23.09	20.19

1/ Based on merchantable top diameter.

Table 15.- Average tree measurements and values of insect Risk Class 4 by four inch diameter groups.

	Four inch tree d.b.h. groups							
	18-21	22-25	26-29	30-33	34-37	38-41	42-45	All groups
Number of trees	1	1	3	1	1	3	1	11
Average d.b.h. (inches)	21.5	23.5	28.1	32.4	35.8	38.8	42.1	32.4
Average surfaced tally,(feet b.m.)	544	553	894	1155	1654	1761	2802	1331
Average gross scale,board feet 1/	470	620	890	1470	2080	2253	3110	1562
Average net scale, board feet	470	620	870	1140	1880	1807	3090	1385
Overrun, percent, gross scale	+15.7	-10.8	-0.7	-21.4	-20.5	-21.8	-9.9	-14.8
Overrun, percent net scale	+15.7	-10.8	+1.6	+ 1.3	-12.0	- 2.5	-9.3	- 3.9
Cull percent	-	-	2.2	22.4	9.6	19.8	0.6	11.4
Value per M b.m. Schedule B (dollars)	20.97	19.30	19.26	18.59	23.21	15.00	19.54	18.24
Value per M gr. sc. Schedule B (dollars)	24.27	17.21	19.13	14.60	18.45	11.75	17.61	15.54
Value per M net sc. Schedule B (dollars)	24.27	17.21	19.57	18.83	20.41	14.65	17.72	17.53

1/ Based on merchantable top diameter

Table 16.-- Average tree measurements and values of all trees combined by four inch diameter groups

	Four inch tree d.b.h. groups											
	10-13	14-17	18-21	22-25	26-29	30-33	34-37	38-41	42-45	46-49	50-53	All groups
Number of trees	2	7	8	10	10	11	8	15	5	4	3	83
Average d.b.h.(inches)	12.0	16.0	19.3	24.0	27.5	31.5	35.0	39.3	43.0	46.6	51.5	31.0
Average surfaced tally, (feet b.m.)	31	109	316	672	879	1182	1770	2657	3206	3558	5699	1605
Average gross scale, board feet 1/	35	110	306	665	853	1240	1891	2787	3450	3822	5873	1676
Average net scale, (board feet)	35	110	302	651	847	1210	1785	2657	3200	3512	5837	1605
Overrun,percent,gr. scale	-10.3	-0.6	+3.3	+1.1	+3.1	-4.7	-6.4	-4.7	-6.5	-6.9	-3.0	-4.2
Overrun,percent,net scale	-10.3	-0.6	+4.6	+3.3	+3.8	-2.3	-0.8	- *	+0.2	+1.3	-2.4	+ *
Cull percent	-	-	1.2	2.1	0.7	2.4	5.6	4.7	6.7	8.1	0.6	4.2
Value per M b.m.Sched.B (dollars)	16.56	16.15	19.44	18.21	20.31	19.92	21.36	22.47	21.42	22.65	27.19	22.15
Value per M gr.sc.Sched.B (dollars)	14.86	16.05	20.09	18.41	20.93	18.99	20.00	21.42	20.02	21.09	26.38	21.22
Value per M net sc.Sched.B (dollars)	14.86	16.05	20.34	18.81	21.08	19.46	21.19	22.46	21.46	22.95	26.55	22.15

1/ Based on merchantable top diameter.
* = Less than .05 percent.

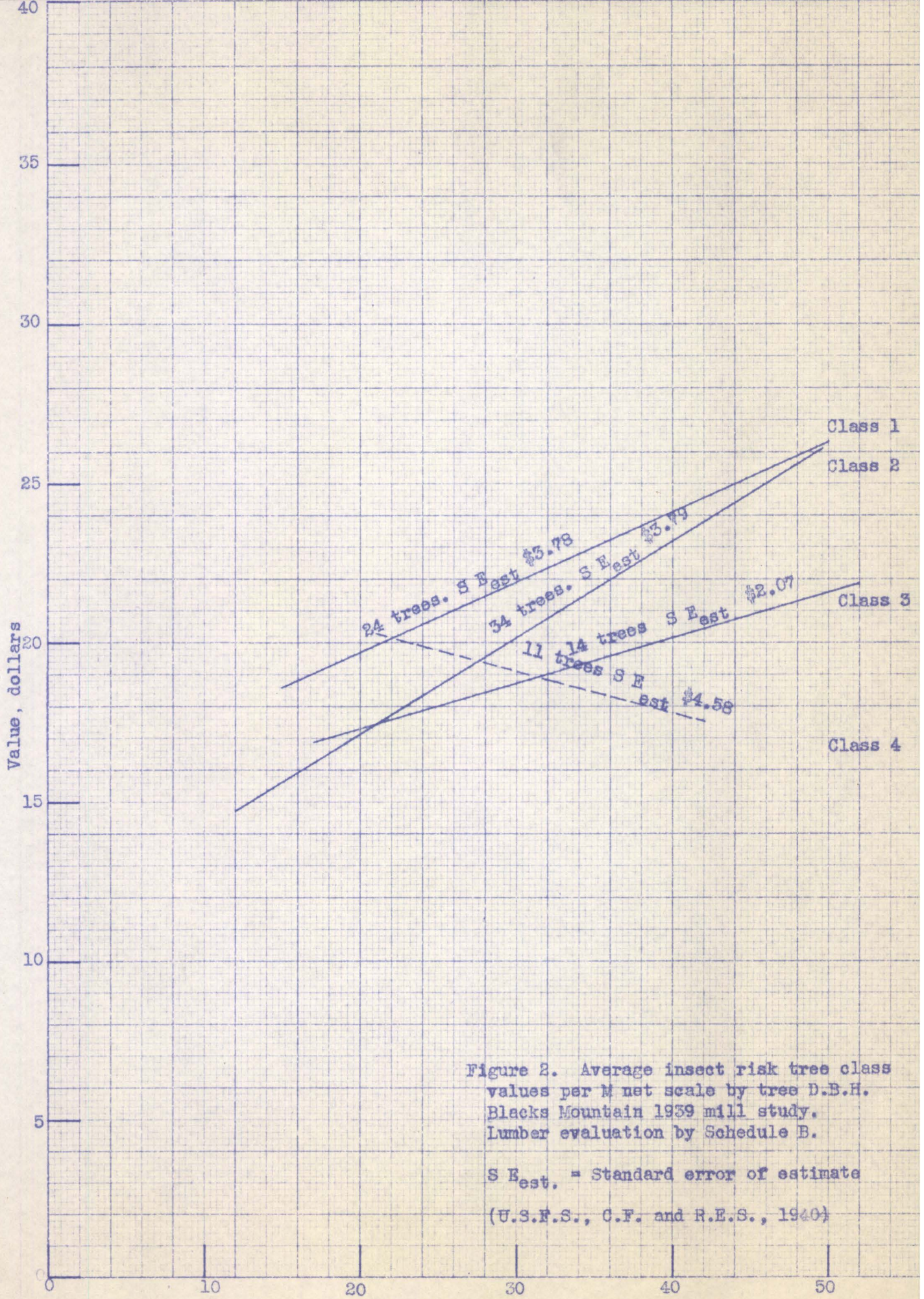


Figure 2. Average insect risk tree class values per M net scale by tree D.B.H. Blacks Mountain 1939 mill study. Lumber evaluation by Schedule B.

$S E_{est.}$ = Standard error of estimate

(U.S.F.S., C.F. and R.E.S., 1940)

The above analysis shows that from this sample we are not reasonably certain that the average differences in value between classes 1 and 2 and between 2 and 3 are not due to the chances of sampling. However, it is only a very remote probability that the average difference in value between insect classes 1 and 3 at 31 inches is attributable to chances of sampling in the stand under examination.

It must be reiterated here that this study is one of a series which have been planned to investigate the possibility of associating tree descriptions with lumber selling values. Each study is to sample a different stand and is to embrace a number of trees compatible with efficient field work. Procedure will be identical for all studies so that the results may be accumulated. Each study may be designed for sampling in any of a number of classification systems, and choice of trees may be varied according to classes or sizes required. As the studies are added together, whenever a sufficient number of trees of a given classification is accumulated, conclusions about the values of the classification may be based on statistical analysis. It was recognized in the plan that the size of sample for each study was not determined by the requirements of statistical validity.

Since this study has been confined to a 20 acre sample plot, conclusions from it should not be accepted as applicable to any great area of ponderosa pine without confirmation from further study in a stand of different description. For instance, the stand on this plot may be compared with the stand of the four 1938 cutting plots in the following summary. Only trees 20 inches and over, D.B.H., are included.

	1938 Plots 1 to 4	1939 Plot 4
Number of trees per acre	15.5	9.1
Average D.B.H. (inches)	29.0	32.4
Number of merchantable logs per tree	4.5	3.4
Logs of different grade		
in per cent of total logs - Grade 1	3.1	4.3
" 2	7.7	6.4
" 3	8.1	8.2
" 4 & C	36.2	26.6
" 5	36.9	28.5
" 6	8.0	26.1

The study plot has fewer and shorter trees than the 1938 plots and its average tree contains a larger proportion of logs of grade 5 and 6.

Obviously the merchantable trees in these two stands are different in form and value, and it would be wrong to assume that relationships found in one stand would apply in the other.

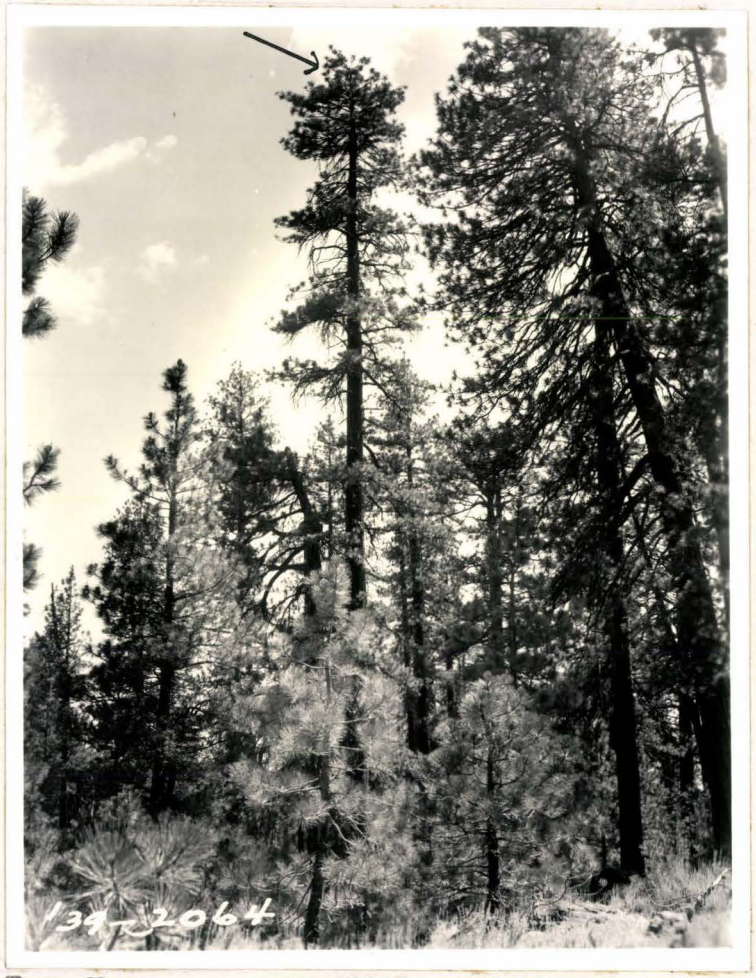
Since insect risk classification is of prior interest, we have, in this first study of the series, attempted to obtain an indication of the advisability of choosing trees in another study on the basis of this classification. The results show that in one type of stand there is an indication of decline in value with increase in insect risk. We may not conclude that there is a regular value relationship between the risk classes, nor may we predict the value-diameter relationship within each class. It is certain that the next study should be directed toward the insect risk class problem.

If another study of about 100 trees in a different type of stand yields results comparable to this one it will be much more possible to generalize on the relative value of insect risk class trees. Before value-diameter prediction is attempted there should be an accumulation of about 100 trees in each risk class and representation of as many stands as practicable.

The photographs on the following pages show 16 trees that were included in this study, 4 representatives of each insect risk class. Photographs by T. J. Orr, Jr.

Tree No.	1906
Insect Risk Class	1
D.B.H., inches	19
Log Grades	3 C C

Tree No.	2017
Insect Risk Class	1
D.B.H., inches	35
Log Grades	2 5 5 5 5 6



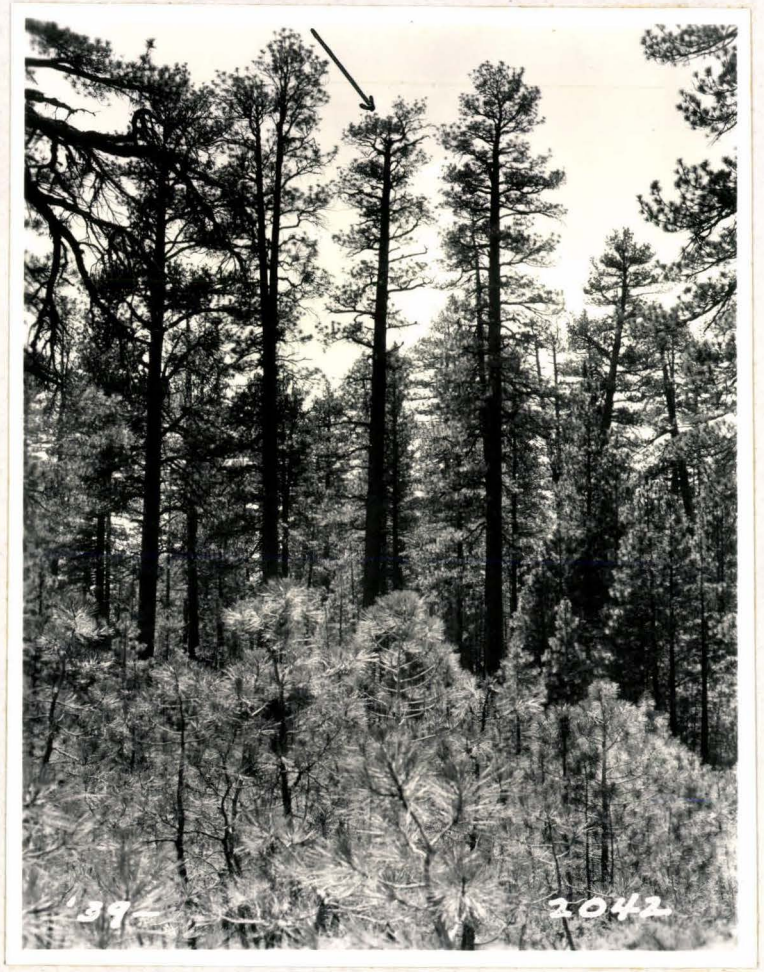
Tree No.	2064
Insect Risk Class	1
D.B.H., inches	39
Log Grades	1 3 3 5 5 6

Tree No.	2044
Insect Risk Class	1
D.B.H., inches	42
Log Grades	1 3 5 5 6 6

Tree No.	2019
Insect Risk Class	2
D.B.H., inches	20
Log Grades	1 C 5

Tree No.	2000
Insect Risk Class	2
D.B.H., inches	24
Log Grades	2 5 5 5

Tree No.	1946
Insect Risk Class	2
D.B.H., inches	30
Log Grades	1 3 5 5 5

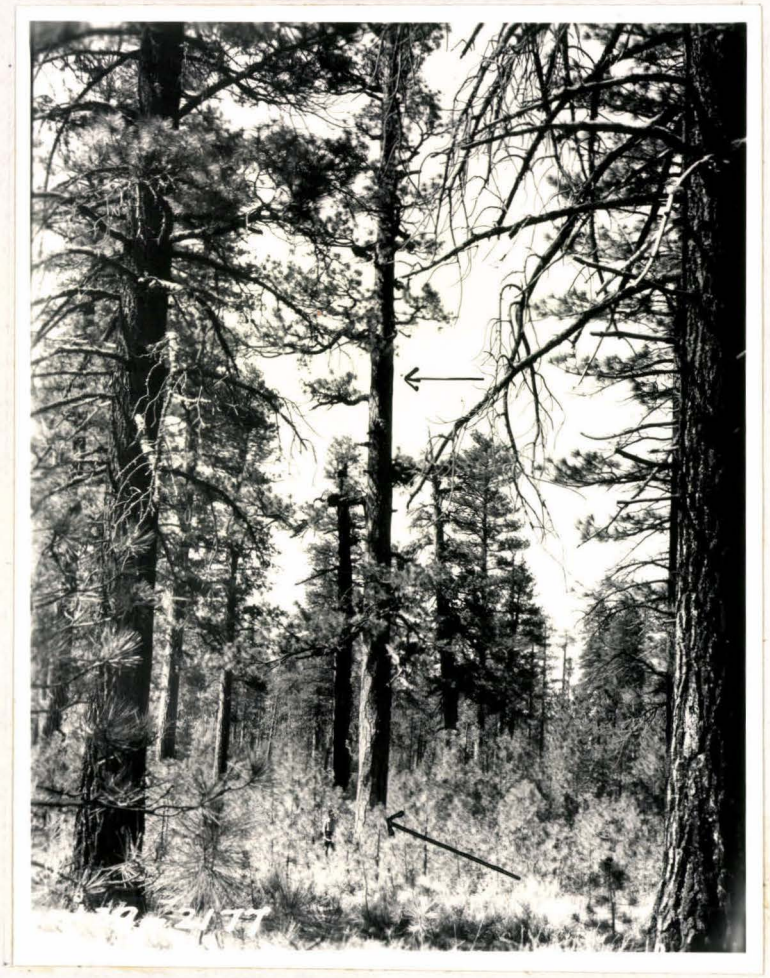


Tree No.	2042
Insect Risk Class	2
D.B.H., inches	39
Log Grades	1 4 4 5 5 6

Tree No.	2120
Insect Risk Class	3
D.B.H., inches	20
Log Grades	3 5 4

Tree No.	2144
Insect Risk Class	3
D.B.H., inches	25
Log Grades	2 4 5 6 6

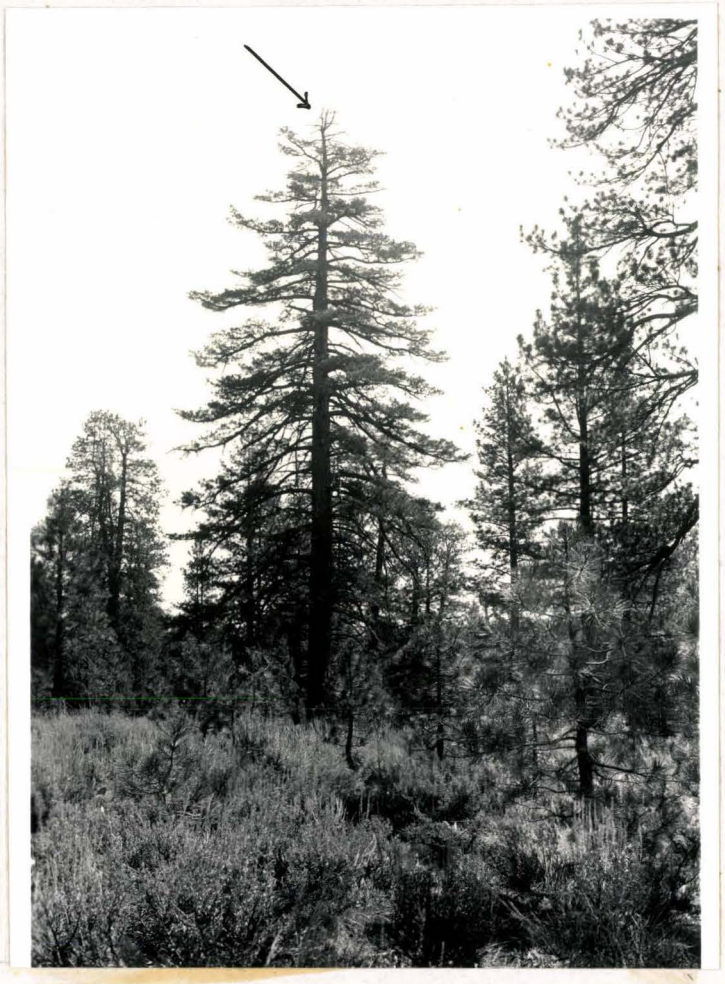
Tree No.	2134
Insect Risk Class	3
D.B.H., inches	25
Log Grades	1 4 5 5 C



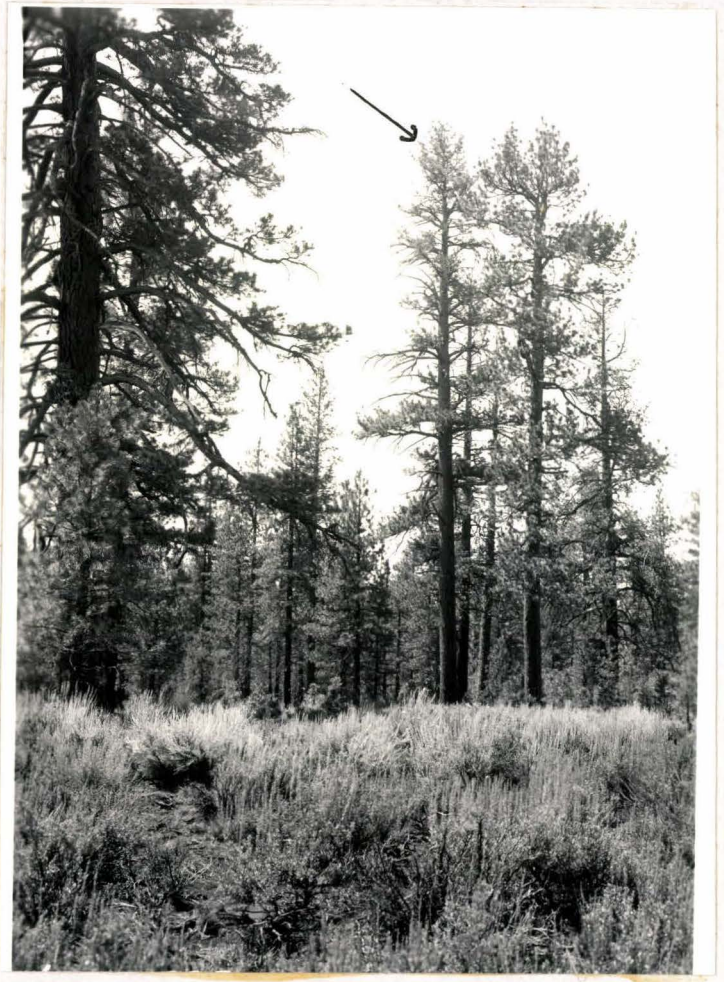
Tree No.	2177
Insect Risk Class	3
D.B.H., inches	41
Log Grades	2 3 6 5 5 6

Tree No.	2052
Insect Risk Class	4
D.B.H., inches	21
Log Grades	1 3 3 4

Tree No.	1936
Insect Risk Class	4
D.B.H., inches	38
Log Grades	1 5 4 4



Tree No.	2036
Insect Risk Class	4
D.B.H., inches	39
Log Grades	4 6 6 6 6 6



Tree No.	1922
Insect Risk Class	4
D.B.H., inches	39
Log Grades	3 5 5 6 6 6